Marine Timber-Boring Organisms of the Indian Coast

Report on a Collection from the South-East Coast of India, with Notes on Distribution in the Indo-Pacific Area

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Introduction

Earlier studies along the east and west coasts of India have shown that timber-boring animals cause extensive damage to all sorts of marine underwater structures made of timber (Nair 1961). Systematically, the timber-borers constitute a heterogeneous assemblage representing at least two phyla and eight genera in the Indian waters all sharing a common habitat and working together in the destruction of wood in sea-water, in brackish water, and even in fresh water. The phylum Mollusca is represented mainly by four genera, namely *Bankia*, *Nausitora*, and *Teredo*, which constitute the family Teredinidae or shipworms, and the genus *Martesia* of the family Pholadidae or piddocks. The crustacean wood-borers are mainly confined to the order Isopoda and are represented by the two well-known genera *Sphaeroma* and *Limnoria*. Four species and one variety of *Sphaeroma* and nine species of *Limnoria* have been reported from India. The amphipod borer *Chelura* has not yet been recorded from the Indian coast.

The nature of attack by the molluscs differs from that by the crustaceans and produces different effects on the timber, thus enabling them to share without serious competition a habitat which is limited in extent. While the crustaceans work from the outside, the molluscs penetrate deep into the heart of the timber. The combined action of the two groups of borers converts the wood into a highly porous,

fragile, and honeycombed mass. The limnoriids even enter the creosoted shell of treated timber but the shipworm larvae seem unable to do this. As suggested by Menzies (1957), this may be due to the fact that teredines penetrate the wood as larval forms whereas the crustaceans penetrate the wood as adults. The shipworms are important destroyers of timber, since the growth of these highly specialised wood-borers is directly related to the damage they effect on timber and each shipworm during its lifetime destroys a column of wood of the same dimensions as itself. The piddocks are also equally important because of their wide distribution, density of attack, quick development, rapid succession of generations, and high tolerance of lower salinities (Nagabhushanam 1955). Even though the bore hole of the piddock is much smaller than that of the shipworm and does not usually exceed the size of the animal itself, the noteworthy feature is that each generation penetrates deeper and deeper, thereby considerably reducing the useful period of timber structures. Among the crustacean borers along the Indian coasts those of the genus *Sphaeroma* are the most important owing to their larger size, the burrow being about twice as large as the body, the high density of settlement, and the rapid rate of reproduction. Further, these crustaceans can also tolerate great reduction in the salinity of the medium which enables them to spread to the brackish waters. Three species are commonly met with in Indian waters, namely *S. terebrans*, *S. annandalei*, and *S. walkeri*. The genus *Limnoria* which is a very serious timber-borer in the higher latitudes is not a serious pest in Indian waters, even though nine species have so far been recorded (including those from Minicoy and the Andamans). They are *Limnoria pfefferi* Stebbing, *L. insulae* Menzies, *L. unicornis* Menzies, *L. platycauda* Menzies, *L. indica* Becker & Kampf, *L. bituberculata* Pillai, *L. tripunctata* Menzies, *L. septima* Barnard, and *L. bombayensis* Pillai. This small isopod is capable of effecting a progressive tunnelling action on wood and can make a burrow many times the length of its body. *Metaponorthus* and *Melita* have also been reported as capable of boring wood but are not serious pests.

Taxonomic studies have shown (Nair 1961) that at least 28 species of shipworms occur and are active in the Indian waters and constitute one of the most important and highly destructive timber borers along our coasts. They attack and destroy a wide variety of timber structures. It is probable that an extensive search of the wooden underwater structures along the Indian coast, the driftwood cast ashore during the monsoon, and particularly the water-logged timber that can be obtained by dredging would yield very valuable material

which may expand this list still further. Several expeditions have reported the occurrence of remnants of plant material of land origin in deep water, particularly in the tropics, and the hauls from some parts of the deep sea are extraordinarily rich in different species of plant material and marine boring organisms. Such materials have neither been collected nor studied in any detail from the neighbourhood of India. The data would provide valuable material for understanding the nature, occurrence, distribution, and dispersal of wood borers in these waters. It is of interest to note that all the 17 species of *Xylophaga*, a wood-boring genus collected from the deep sea during the Galathea Expedition (Knudsen 1961), were new to science, which shows that the forms occurring in these habitats are quite different from those that occur in driftwood or in shallow waters.

Further most surveys of marine wood-boring organisms have been restricted to easily accessible sea-coasts and protected harbour areas, where test boards can be easily installed and examined as and when desired. Moreover, the destruction which these borers cause is chiefly detected on the harbour constructions, such as piers and wharves, which quickly attract the attention of harbour engineers and industrialists interested in waterfront structures. So our information about these pests is chiefly confined to their ecology near the narrow coastal zones and harbours. Their occurrence, distribution, relative abundance, conditions of life, and survival during the larval stages, soon after settlement on wood, and also the reproducing adult stages in the environment of the distant off-shore waters are all imperfectly understood.

A careful study of the reports from the east and west coasts of India and the neighbouring areas indicates that many of these wood-boring animals are widely distributed not only along the coasts of India but also in the Indo-Pacific area extending from the east African coasts, through Indonesia, to Samoa and Hawaii.

The present account is based on a collection of wood-boring animals made during December 1961 and February 1962 from two localities, namely Pamban on the Rameswaram Island and Keelakkarai near Ramnad on the south-east coast of India. It is hoped that this report, though not exhaustive, will be beneficial to zoologists, since this and adjacent areas particularly Krusadai are visited by a large number of scientists every year. The fauna of Krusadai studied in great detail for the last several years does not include a single shipworm.

Wood-boring Molluscs

Family Pholadidae

This family is represented by the Genus *Martesia* and two species are present in the collection, namely *Martesia striata* and *Martesia fragilis.*

Genus **Martesia** Sowerby

Subgenus **Martesia** Sowerby

1. **Martesia (Martesia) striata** (Linné)

1758. *Pholas striata* Linné, Syst. Nat. ed. **10** : 669.

Occurrence. Several specimens were collected from old piles (*Borassus flabellifer*) both from Pamban and Keelakkarai. Specimens (shells only) have also been collected from driftwood of the following species cast ashore, *Mangifera* sp., *Casuarina* sp., *Acacia* sp., *Bamboosa* sp.

Previous records from India. Madras, Porto-Novo, Tuticorin, Kayankulam (west coast), Cochin Harbour, Bombay, Visakhapatnam, Krishna estuary, and Krusadai.

Distribution. Eastern Pacific, Indo-Pacific, Western Atlantic.

2. **Martesia (Martesia) fragilis** Verrill & Bush

1890. *Martesia* (*Martesiella*) *fragilis* Verrill & Bush, *Proc. U. S. Nat. Mus.* **20** : 777.

Occurrence. Several specimens were obtained from a drift log (timber undetermined) cast ashore on Keelakkarai beach on 19 February 1964.

Previous records from India. Porto-Novo, Madras, Cochin.

Timber known to be attacked. Myristica fragrans, Mangifera indica, Bamboosa sp.

Distribution. Western Atlantic, Eastern Pacific.

Family Teredinidae

This family includes the well-known shipworms and are the most important of the wood-borers collected. The genera *Bankia* and

Teredo are represented in the collection, the former by four species and the latter by eight species.

Genus **Bankia** Gray

Subgenus **Bankia** Gray

1. **Bankia (Bankia) bipalmulata** (Lamarck)

1801. *Teredo bipalmulata* Lamarck, Systéme des Animaux sans Vertébres: 129.

Occurrence. Three specimens were collected from a log of *Cedrela toona* cast ashore during December 1961 at Pamban. Dry shells and pallets have also been recovered from driftwood such as *Shorea* sp. and other as yet undetermined timber.

Previous records from India. Pondicherry, Madras, Kovilam.

Distribution. East African coast; Tanganika (Tanga); Sumatra (Babalan, Soeng Sang); Philippines (Mindoro); New Guinea (Manokwari); New Hebrides (Espiritu Santo); New Caledonia; Hawaii (Oahu).

Subgenus **Bankiella** Bartsch

2. **Bankia (Bankiella) indica** Nair

1954. *Bankia* (*Bankiella*) *indica* Nair, *Rec. Ind. Mus.* **52** : 393.

Occurrence. Several specimens were collected from a piece of driftwood cast ashore at Pamban.

Timber known to be attacked. Cedrela toona, Borassus flabellifer, Melia composita, Albizzia moluccana, Shorea robusta, Hopea sp.

Previous records from India. Madras, Adirampatnam, Cochin.

Distribution. Felix Roch (1961) feels that the form under consideration is probably a synonym of *Bankia carinata. B. carinata* has been recorded from the following places, namely Reunion, Malacca, the Sunda Islands, and New Guinea.

Subgenus **Neobankia** Bartsch

3. **Bankia (Neobankia) nordi** Moll

1935. *Bankia* (*Neobankia*) *nordi* Moll, *Sitz.-Ber. Akad. Wiss. Wien, Math.-Natw. Kl.* **1** (144): 272.

Occurrence. Two pallets were collected from the roots of *Pandanus* sp. cast ashore at Pamban.

Previous records from India. This is the first record of this species from India.

Distribution. Sumatra (Balawan Deli, Tandjoeng Balei); Singapore; Rhiouw Archipelago; New Guinea (Fak Fak).

Subgenus **Plumulella** Clench & Turner

4. **Bankia (Plumulella) lineata** Nair

1955. *Bankia* (*Neobankia*) *lineata* Nair, *J. Madras. Univ.* **25**B : 109.

Occurrence. Two specimens were collected from a log of *Cedrela toona* cast ashore at Pamban. Shells and pallets have also been recovered from driftwood (probably *Rhizophora* sp.) from the same locality.

Previous records from India. Madras, Visakhapatnam.

Genus **Teredo** Linné

Subgenus **Teredo** S. Str. Linné

5. **Teredo (Teredo) madrasensis** Nair

1954. *Teredo* (*Teredo*) *madrasensis* Nair, *Rec. Ind. Mus.* **52** : 401.

Occurrence. Several shells and pallets were obtained from pieces of driftwood cast ashore at Pamban.

Previous records from India. Madras, Kayankulam, Tondi, Adirampatnam.

Timber known to be attacked. Cedrela toona, Mangifera indica, Borassus flabellifer, Tectona grandis, Shorea sp., *Terminalia* sp.

Subgenus **Teredothyra** Bartsch

6. **Teredo (Teredothyra) indomalaica** Roch

1935. *Teredo* (*Teredothyra*) *indomalaica Roch, Sitz.-Ber. Akad. Wiss. Wien, Math.-Natw. Kl.* **1** (144) : 264.

Occurrence. Two pairs of pallets from a piece of driftwood (*Shorea* sp. ?) cast ashore at Pamban.

Previous records from India. Nil.

Distribution. Madagascar, Malacca, Singapore, Rhiouw Archipelago, Tandjoeng Penang, Sumatra (Oleh Lheue).

Subgenus **Lyrodus** Gould

7. **Teredo (Lyrodus) malaccana** Roch

1935. *Teredo* (*Lyrodus*) *malaccana* Roch, *Sitz.-Ber. Akad. Wiss. Wien., Math Natw. Kl.* **1** (144) : 269.

Occurrence. Several pairs of pallets were collected from pieces of driftwood (*Shorea* sp. ?, *Myristica fragrans, Bamboosa* sp.) at Pamban. A set of four live specimens were collected from the branch of a tree cast ashore at Keelakkarai.

Previous records from India. Visakhapatnam, Mandapam, Cochin, Bombay.

Distribution. Suez Canal (Ismailia), Aden, East African coast: Kenya (Mombasa), Tanganika (Tanga), Madagascar, Rhiouw Archipelago, Tandjoeng Penang, Singapore, Sumatra (Oleh Lheue, Belawan Deli), Java (Surabaja), Borneo (Kota Baru), New Guinea (Fak Fak).

Subgenus **Coeloteredo** Bartsch

8. **Teredo (Coeloteredo) singaporeana** Roch

1935. *Teredo* (*Coeloteredo*) *singaporeana* Roch, *Sitz.-Ber. Akad. Wiss. Wien, Math.-Natw. Kl.* **1** (144) : 266.

Occurrence. Four specimens were collected from the floating branch of a tree at Pamban.

Previous records from India. Visakhapatnam.

Distribution. East African coast: Kenya (Mombasa), Tanganika (Tanga, Pangani), Port Durban, Madagascar, Malacca, Singapore, Rhiouw Archipelago, Sumatra (Sabang, Emmahaven). Lombok (Ampenan).

9. **Teredo (Coeloteredo) renschi** Roch

1935. *Teredo* (*Coeloteredo*) *renschi* Roch, *Sitz.-Ber. Akad. Wiss. Wien., Math. Natw. Kl.* **1** (144) : 267.

Occurrence. Two specimens from the bark of a palm tree (*Borassus flabellifer*) cast ashore at Keelakkarai.

Previous records from India. Mandapam, Cochin.

Distribution. Rhiouw Archipelago, Singapore, Sumatra (Sabang), Java (Surabaja), Flores (Endeh).

Subgenus **Kuphus** Guettard

10. **Teredo (Kuphus) manni** Wright

1866. *Kuphus* ? *manni* Wright, *Trans. Linn. Soc. London* **25** : 565.

Occurrence. Two pallets were obtained from a piece of driftwood, *Tectona grandis,* cast ashore at Keelakkarai.

Previous records from India. Bombay, Visakhapatnam, Cochin.

Distribution. East African coast: Kenya (Mombasa), Tanganika (Tanga, Pangani), Mozambique (Mayotte, San Diego, Beira, Tongaland), Kerimba Islands, Madagascar, Reunion, Cochin China, Burma (Tavoy), Malacca, Singapore, Rhiouw Archipelago, Sumatra (Babalan, Belawan Deli, Pantai Tjermin, Soeng Sang, Langsa River), Tandjoeng Penang, Celebes (Moena), Moluccas (Amboina), Borneo (Kota Baru),

Java (Surabaja), New Guinea (Fak Fak, Meranke, Hollandia Harbour, Seegarbui), Philippines (Luzon, Palawan), Bismarck Archipelago, Australia (Queensland).

Subgenus **Uperotus** Guettard

11. **Teredo (Uperotus) clava** Gmelin

1791. *Teredo clava* Gmelin, *Syst. Nat.*, ed. 13, : 3748.

Occurrence. Several specimens were collected from the floating seeds of mangrove from both Pamban and Keelakkarai.

Previous records from India. Madras, Karaikal, Pondicherry, Tranquebar.

Distribution. East African coast: Cape Province (Port Elizabeth), Natal, Mauritius, Ceylon, Java, Moluccas (Amboina), Philippines, Australia (Queensland, Sydney).

Subgenus **Dactyloteredo** Roch

12. **Teredo (Dactyloteredo) diederichseni** Roch

1929. *Teredo* (*Dactyloteredo*) *diederichseni* Roch, *Mitt. Zool. Staatsinst. Zool. Mus. Hamburg.* **44** : 6.

Occurrence. Several shells and pallets were collected from a big drift log (timber undetermined) cast ashore at Pamban.

Previous records from India. Madras, Cochin.

Distribution. Philippines, the Sunda Islands, Phoenix Islands (Canton), Midway Islands, Wake Islands, Hawaii Islands (Kuai, Oahu, Maui, Hilo, Johnston).

Wood-boring Crustaceans

One species of *Limnoria* and two species of *Sphaeroma* are represented in the collection.

Family Limnoriidae

Genus **Limnoria** Leach

Subgenus **Limnoria** Menzies

1. **Limnoria (Limnoria) indica** Becker & Kampf

1957. *Limoria* (*Limnoria*) *indica* Becker & Kampf, *Journal of the Timber Dryers and Preservers Association of India* **5** (1) : 12-17.

Occurrence. Six specimens were collected from green twigs cast ashore at Keelakkarai. All specimens were alive when collected.

Their burrows were shallow just beneath the bark of the twigs and the infestation was light.

Previous records from India. Mandapam camp, Madras Harbour.

Family SPHAEROMIDAE

Genus **Sphaeroma** Bosc

2. **Sphaeroma walkeri** Stebbing

1905. *Sphaeroma walkeri* Stebbing, *Ceylon Pearl Oyster Fishery Suppl. Rep.* 23 : 31.

Occurrence. Two specimens both in a dried condition were collected from a drift log cast ashore at Pamban.

Previous records from India. Neendakara near Quilon, Bombay, Madras, Visakhapatnam.

Distribution. Ceylon, Suez, Egypt, New South Wales, South Africa.

3. **Sphaeroma terebrans** Bate

1866. *Sphaeroma terebrans* Bate, *Ann. Mag. nat. Hist.* 3 (17) : 28.

Occurrence. Several specimens were collected in a dry condition from a large drift log cast ashore at Pamban.

Previous records from India. Backwaters of Travancore-Cochin, Madras, Mandapam, Bombay.

Distribution. Mediterranean, Mozambique, Zanzibar, North and South Africa, Ceylon, Queensland, Florida, and Brazil.

TABLE I

THE DISTRIBUTION OF SHIPWORMS

Name of shipworm	Pacific Ocean	Indian Ocean	Suez Canal	Red Sea	Mediterranean Sea	Atlantic Ocean
Bankia bipalmulata ..	*	*	–	–	–	–
Bankia indica ..	?	*	–	–	–	–
Bankia nordi ..	–	*	–	–	–	–
Bankia lineata ..	–	*	–	–	–	–
Teredo indomalaica ..	–	*	–	–	–	–
Teredo malaccana ..	–	*	*	–	–	–
Teredo (diederichseni T. gregoryi) ..	*	*	–	–	–	–
Teredo singaporeana ..	–	*	–	–	–	–
Teredo renschi ..	–	*	–	–	–	–
Teredo manni ..	*	*	–	–	–	–
Teredo clava ..	*	*	–	–	–	–

* present; – absent

TABLE II

TIMBERS ATTACKED BY BORING MOLLUSCS

Name of timber	*Martesia striata*	*Martesia fragilis*	*Bankia bipalmulata*	*Bankia indica*	*Bankia lineata*	*Teredo madrasensis*	*Teredo manni*	*Teredo indomalaica*	*Teredo malaccana*
Tectona grandis ..	–	–	–	–	–	*	*	–	–
Borassus flabellifer ..	*	–	–	*	–	*	–	–	–
Terminalia sp. ..	–	–	–	–	–	*	–	–	–
Myristica fragrans ..	–	*	–	–	–	*	–	–	*
Cedrela toona ..	–	–	*	*	*	*	–	–	–
Mangifera indica ..	*	*	–	–	–	*	–	–	–
Melia composita ..	–	–	–	*	–	–	–	–	–
Albizzia moluccana ..	–	–	–	*	–	–	–	–	–
Casuarina sp. ..	*	–	–	–	–	–	–	–	–
Pandanus sp. ..	–	–	–	–	–	–	–	–	–
Acacia sp. ..	*	–	–	–	–	–	–	–	–
Shorea robusta ..	–	–	*	*	–	*	–	*	*
Hopea sp. ..	–	–	–	*	–	–	–	–	–
Rhizophora sp. ..	–	–	–	–	–	–	–	–	–
Bamboosa sp. ..	*	*	–	–	–	–	–	–	–

* present ; – absent

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